

10/521,948

PTO 09-1382

CC=JP DATE=19770910 KIND=A
PN=52108427

SOLUBILIZATION METHOD OF DYE INTO AROMATIC HYDROCARBON SOLVENT
[Senryou no houkouzoku tankasuiso kei youzai eno kayouka houhou]

Isao Niimura, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. December 2008

Translated by: FLS, Inc.

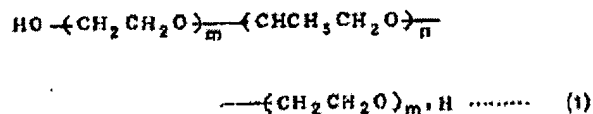
PUBLICATION COUNTRY	(19):	JP
DOCUMENT NUMBER	(11):	77-108428
DOCUMENT KIND	(12):	
PUBLICATION DATE	(43):	19770910
APPLICATION NUMBER	(21):	SHO51-025049
APPLICATION DATE	(22):	19760310
INTERNATIONAL CLASSIFICATION	(51):	C 09 B 67/00; C 08 L 71/02
PRIORITY COUNTRY	(33):	
PRIORITY NUMBER	(31):	
PRIORITY DATE	(32):	
INVENTOR(S)	(72):	NIIMURA, ISAO; MAEDA, SHIGEO; HOSHINO, KENICHI; SAKAI, TAKAYUKI
APPLICANT(S)	(71):	HODOGAYA KAGAKU KOGYO CO.
DESIGNATED CONTRACTING STATES	(84):	
TITLE	(54):	SOLUBILILZATION METHOD OF DYE INTO AROMATIC HYDROCARBON SOLVENT
FOREIGN TITLE	[54A]:	SENRYO NO HOUKOUZOKU TANKASUI SO KEI YOUZAI ENO KAYOUKA HOUHOU

1. Title of the Invention

SOLUBILIZATION METHOD OF DYE INTO AROMATIC HYDROCARBON SOLVENT

2. Claims

A solubilization method of a dye into an aromatic hydrocarbon solvent characterized by a mixing treatment of said dye with a polymer prepared from polypropylene glycol and ethylene oxide having a general formula as shown below:



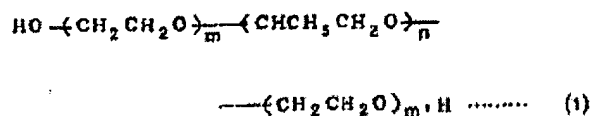
(wherein in the above formula, n is integers of 15 ~ 50; m + m' is integers of 5 ~ 30; and the sum of m + m' + n is 20 ~ 80).

3. Detailed explanation of the invention

The present invention relates to a solubilization method of a dye into an aromatic hydrocarbon solvent such as benzene, toluene, xylene, cymene, naphthalene, styrene and the like.

Explaining in more detail, the present invention relates to a solubilization method of a metal complex salt dye, a copper phthalocyanine dye and a disperse dye into an aromatic hydrocarbon solvent by a mixing treatment of the above dyes with a polymer prepared from polypropylene glycol and ethylene oxide having a general formula as shown below:

*Numbers in the margin indicate pagination in the foreign text.



(wherein in the above formula, n is integers of 15 ~ 50; m + m' is integers of 5 ~ 30; and the sum of m + m' + n is 20 ~ 80).

Conventionally, as solvent-soluble dyes, 2:1 type metal complex salt dye which is subjected to a salt-forming treatment with an aliphatic amine, an alicyclic amine or a heterocyclic amine (JP-B (Tokko) Sho41-12915 Detailed specification, JP-B (Tokko) Sho44-6597 Detailed specification) or with an aliphatic quaternary ammonium salt (JP-A (Tokkai) Sho48-8316 Detailed specification) have been known. For a copper phthalocyanine /136 dye, that having a sulfonic acid group which is subjected to a salt-forming treatment with an alkylamine [Zabon Fast Blue HFL, from BASF, Senryou Binran (Dye Handbook), new edition, P 865, Edited by the Organic Synthesis Chemistry Society] or with an alkoxyalkylamine (JP-B (Tokko) Sho44-3218 Detailed specification) have been known. For an acid dye, that which is subjected to a salt-formation treatment with an alicyclic amine (Zabon Fast Yellow CGG, from BASF Co., Dye Handbook, P 840, Edited by the Organic Synthetic Chemistry Society) has been known. However, although those dyes are soluble in a polar solvent such as ethanol, acetone, methyl cellosolve, methyl ethyl ketone, ethylene glycol, ethyl acetate, n-butanol and the like, they are almost completely insoluble in an aromatic hydrocarbon solvent such as benzene, toluene, xylene, styrene, cymene, naphthalene and the like. Even if they are soluble, the amount which can be dissolved is very small.

The present inventors have done extensive research concerning the dye which is soluble in an aromatic hydrocarbon solvent and discovered that by a simple physical mixing of the dye with a polymer prepared from polypropylene glycol and ethylene oxide as shown in the general formula (1), the dye exhibits better-than-expected solubility into an aromatic hydrocarbon solvent such as styrene, benzene, toluene, xylene, cymene, naphthalene and the like, which has led to the completion of the present invention.

The present inventors have already submitted patent applications concerning a method of manufacturing a 2:1 type metal complex salt dye which is soluble in a hydrocarbon solvent in JP-A (Tokugan) Sho48-60325 and JP-A (Tokugan) Sho48-44223. Those patent applications have a characteristic in that a sodium salt, a potassium salt, or an ammonium salt of 2:1 type metal complex salt dye is subjected to a salt-formation treatment with a fatty acid salt of N-alkyl-substituted alkylenediamine. Also, in the JP-A (Tokugan) Sho50-28650, the patent application for another solubilization method of 2:1 type metal complex salt dye in the hydrocarbon solvent has been submitted. In this method, an aliphatic ammonium salt or alicyclic ammonium salt of 2:1 type metal complex salt dye is subjected to a mixing treatment with a fatty acid salt of N-alkyl-substituted alkylenediamine. Also, in regard to a method of manufacturing a hydrocarbon solvent-soluble copper phthalocyanine dye, the patent application has been submitted in JP-A (Tokugan) Sho48-59698. In this patent application, a sodium salt, a potassium salt, or an ammonium salt of copper phthalocyaninesulfonic acid

is subjected to a salt-formation treatment with a fatty acid salt of N-alkyl-substituted alkylenediamine. Also, the patent application has been submitted concerning another method of manufacturing a hydrocarbon solvent-soluble copper phthalocyanine dye in the JP-A (Tokugan) Sho50-48653. In this patent application, an aliphatic ammonium salt or alicyclic ammonium salt of copper phthalocyaninesulfonic acid is subjected to a mixing treatment with a fatty acid salt of N-alkyl-substituted alkylenediamine.

In the method of the present invention, dyes can be easily made aromatic hydrocarbon-soluble by a simple mixing treatment of the dye with a polymer prepared from polypropylene glycol and ethylene oxide as shown by the general formula (1).

That is, in the first method of the present invention, a dye can be made easily solubilized in an aromatic hydrocarbon solvent by first dispersing the dye in the aromatic hydrocarbon solvent such as toluene, xylene, cymene, styrene, naphthalene and the like, then, while heating and stirring, adding a polymer prepared from polypropylene glycol and ethylene oxide as shown in the general formula (1) into the dispersion in an amount of at least 100% based on the amount of the dye, or preferably 150 ~ 200%. In this case, by adding the polymer prepared from polyethylene glycol and ethylene oxide, the dye is solubilized in the aromatic hydrocarbon solvent. The obtained solution in which the dye is completely solubilized can be used as it is as a concentrated dye solution or it can be used in a paste form after removing the used solvent.

Furthermore, in the second method, the dye which is soluble in any desired solvent can be obtained easily by simply kneading a mixture of the dye and the polymer prepared from polypropylene glycol and ethylene oxide as shown in the general formula (1) on a 3-roll kneader at room temperature or under heating. In this case, the amount of the polymer prepared from polypropylene glycol and ethylene oxide to be used is at least 100% based on the amount of the dye, or preferably at least 200%. In this case, the dye composition in a paste form which is soluble in the aromatic /137 hydrocarbon solvent can be easily obtained.

As examples of the polymer prepared from polypropylene glycol and ethylene oxide, those having the following structures can be appropriately used:



1) $n = 15$	$m + m' = 5$
2) $n = 20$	$m + m' = 23$
3) $n = 23$	$m + m' = 50$
4) $n = 35$	$m + m' = 10$
5) $n = 17$	$m + m' = 7$
6) $n = 32$	$m + m' = 30$
7) $n = 50$	$m + m' = 18$
8) $n = 27$	$m + m' = 7$
9) $n = 19$	$m + m' = 26$
10) $n = 20$	$m + m' = 10$
11) $n = 14$	$m + m' = 9$
12) $n = 18$	$m + m' = 20$

As examples of the dye which can be appropriately used in the present invention, 2:1 type chrome and cobalt complex salt dyes [C.I. Solvent Yellow

61 (Aizen Spilon Yellow GRH, from Hodogaya Kagaku Co.), C.I. Solvent Red 83 (Aizen Spilon Red BBH, from Hodogaya Kagaku Co.), C.I. Solvent Black 22 (Aizen Spilon Black BH, from Hodogaya Kagaku Co.) and the like], 1:1 type Chrome and Cobalt complex salt dyes [C.I. Solvent Yellow 19 (Zabon Fast Yellow GR, from BASF Co.) and the like], copper phthalocyanine dye (Zabon Fast Blue HFL, from BASF, and the like), and a disperse dye [C.I. Disperse Red 4 (Diaseriton Fast Pink R, from Mitsubishi Kasei Co.), and the like] can be mentioned.

The form of the aromatic hydrocarbon solvent-soluble dye which can be obtained in the present invention is a dye solution containing the solubilizing agent, a dye paste containing the solubilizing agent prepared by removing the solvent from the above dye solution, or a dye paste prepared by the 3-roll kneader (hereinafter, these will be referred to as the dye composition). The paste form of the dye composition may be, in some cases, mixed with an appropriate solvent to be used as a liquid product having an appropriate concentration depending on the use. This indicates that the method of the present invention can overcome the disadvantages of the powder or flake form of the conventional solvent-soluble dyes, which are the common form of the current solvent-soluble dyes, such as a slow dissolution rate into the solvent, difficulty in handling, only a slight solubility into the aromatic hydrocarbon solvents, extra equipment requirements necessary for dissolution of the dye and the like.

Furthermore, one of the major characteristics of the present invention is the fact that the dye can be made soluble into non-polar aromatic

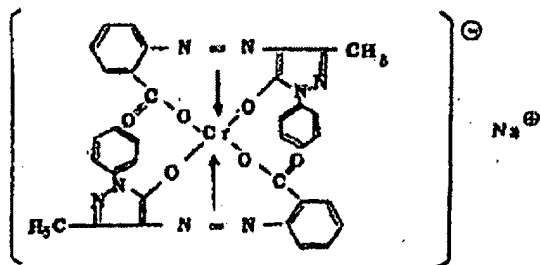
hydrocarbon solvents by a simple mixing treatment of the dye with the polymer prepared from polypropylene glycol and ethylene oxide. This is very advantageous from the standpoint of industrial application. Also, the fact that the dye composition of the present invention exhibits a larger solubility as compared to the current oil-soluble dye is also one of the major characteristics of the present invention.

The dye compositions obtained by the present invention have wide application areas because of their chemical and physical characteristics. For example, they can be used as a variety of inks and lacquers, as an excellent coloring agent for wood materials, oils, natural and synthetic waxes, synthetic resins and the like, and as a coloring modifier for petroleum products such as a gasoline, a lubricating oil and others.

The present invention will be explained in detail using examples. However, the present invention will not be restricted to these examples. In the examples, the terms "parts" and " % " means "weight parts" and "% by weight", respectively, unless described otherwise.

Example 1

The 2:1 type chromium complex salt dye having the structure as shown below:

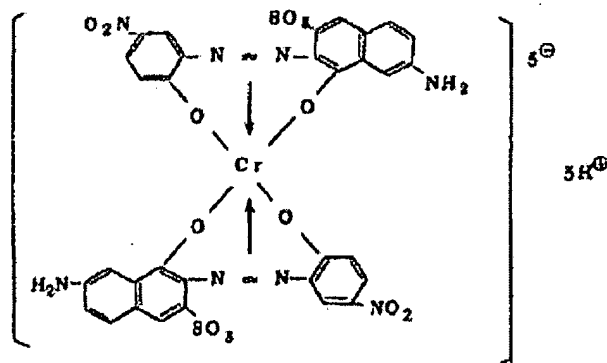


/138



This dye composition was soluble in the aromatic hydrocarbon solvent such as toluene, xylene, styrene and the like, showing a yellow color and exhibiting a solubility of 200 parts/100 volume parts of styrene. On the other hand, 2:1 type chromium complex salt dye, prepared without the above treatment, exhibited a solubility of 0.02 parts/100 volume parts of styrene.

The 2:1 type metal complex salt dye having a structure as shown below:



in an amount of 25 parts was dispersed in 300 volume parts of toluene and mixed with 50 parts of the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown below:



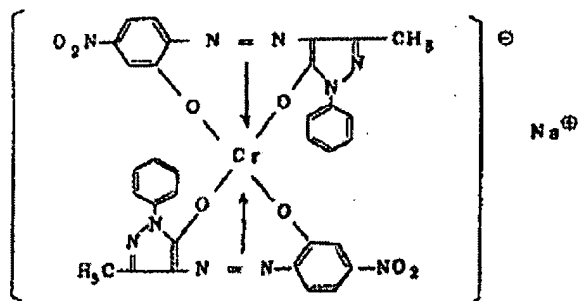
$$n \approx 21, \quad m + m' \approx 20$$

The temperature of the mixture was maintained at 75 ~ 85°C for 1 hour. After confirming that the 2:1 type chromium complex salt dye was completely dissolved, toluene as the solvent was removed to obtain 80 parts of the dye composition.

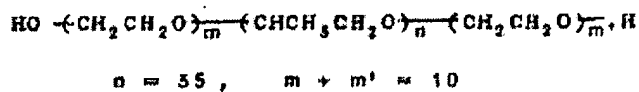
This dye composition was soluble in the aromatic hydrocarbon solvent such as xylene toluene, styrene, and the like, showing a black color and exhibiting a solubility of 250 parts/100 volume parts of benzene. On the other hand, 2:1 type chromium complex salt dye, prepared without the above treatment, exhibited a solubility of 0.01 parts/100 volume parts of benzene.

Example 3

The 2:1 type chromium complex salt dye having a structure as shown below:



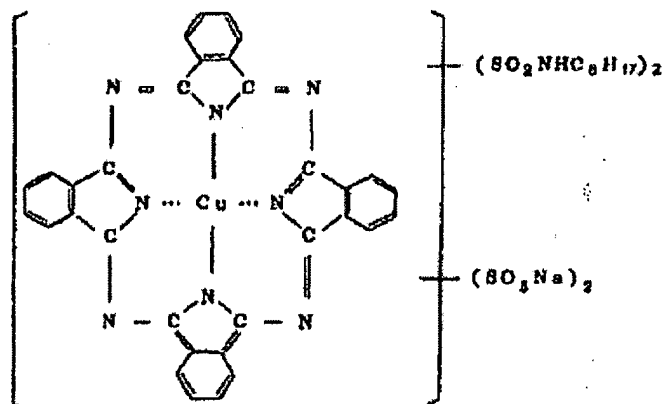
in an amount of 60 parts was dispersed in 100 parts of benzene and mixed with 100 parts of the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown below:



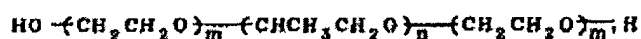
The mixture was heated at 50 ~ 60°C for 0.5 hours to obtain 260 parts of the dye composition solution.

Example 4

The copper phthalocyanine dye having a structure as shown below:



in an amount of 50 parts was dispersed in 250 parts of benzene and mixed with 80 parts of the polymer prepared from polypropylene glycol and /139 ethylene oxide having a structure as shown below:



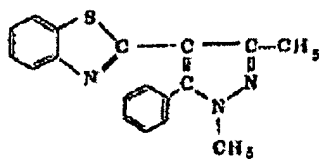
$$n = 17, \quad m + m' = 10$$

The temperature of the mixture was maintained at 50 ~ 60°C for 1 hour. After confirming that copper phthalocyanine dye was completely dissolved, benzene used as the solvent was removed to obtain 133 parts of the dye composition.

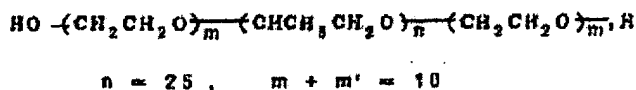
This dye composition was soluble in the aromatic hydrocarbon solvent such as xylene, benzene, toluene and the like, showing a blue color and exhibiting a solubility of 250 parts/100 volume parts of xylene. On the other hand, the above copper phthalocyanine dye, prepared without the above treatment, exhibited a solubility of 0.005 parts/100 volume parts of toluene.

Example 5

The disperse dye having a structure as shown below:



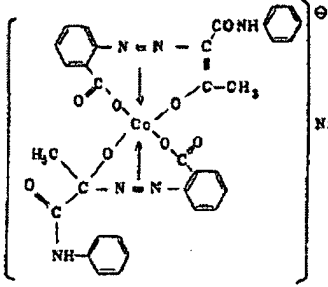
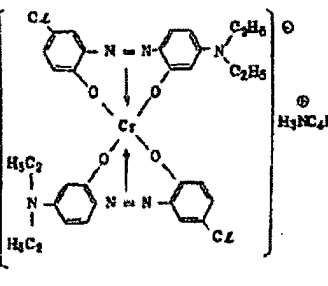
in an amount of 40 parts was dispersed in 400 parts of toluene and mixed with 60 parts of the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown below:



The temperature of the mixture was maintained at 80 ~ 90°C for 2 hours. After confirming that the disperse dye was completely dissolved, toluene as the solvent was removed to obtain 100 parts of the dye composition.

This dye composition was soluble in the aromatic hydrocarbon solvents such as xylene, benzene, toluene, styrene and the like, showing a red-orange color and exhibiting a solubility of 270 parts/100 volume parts of xylene. On the other hand, the above disperse dye, prepared without the above treatment, exhibited a solubility of 0.1 parts/100 volume parts of xylene.

The dyes as shown in the tables below were subjected to a mixing treatment with the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown in the general formula (1) to obtain the aromatic hydrocarbon solvent-soluble dye compositions. The solubility in the tables is the solubility of the dye composition in toluene. The dye composition for the evaluation of the solubility was prepared by removing the solvent from the above dye composition after the completion of the mixing treatment. Also, CuPc means the residue of the copper phthalocyanine group.

1. 例	2. 染料	3. ポリプロピレングリコールとエチレンオキシドとの重合物	4. 混合処理			8. トルエン中の色相	9. 溶解 (染料/トルエン 100 容量部)
			5. 溶媒	6. 温度 (°C)	7. 時間 (h)		
6		$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 51, m + m' = 26$	キシレン 10	90~ 100	1	12 緑黄色	300
7		$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 25, m + m' = 26$	トルエン 11	75~ 80	2	13 赤色	280

Key:

1. Example
2. Dye
3. Polymer prepared from polypropylene glycol and ethylene oxide
4. Mixing treatment
5. Solvent
6. Temperature (°C)
7. Time (h)
8. Color in toluene
9. Solubility (dye/100 volume parts toluene)
10. Xylene
11. Toluene
12. Green-yellow color
13. Red color

1 例	2	3	4 混合処理			8	9
			5	6	7		
8		ポリプロピレングリコールと エチレンオキシドとの重合物 $\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_n-(\text{CHCH}_2\text{CH}_2\text{O})_m-$ $-(\text{CH}_2\text{CH}_2\text{O})_m\text{H}$	ベンゼン 10	50~ 60	3	紫 色 12	270
9	$(\text{SO}_3\text{NHC}_2\text{H}_5\text{NHC}_2\text{H}_5)_2$ CuPt SO_3H	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_n-(\text{CHCH}_2\text{CH}_2\text{O})_m-$ $-(\text{CH}_2\text{CH}_2\text{O})_m\text{H}$ $n = 17, m + m' = 17$	トルエン 11	70~ 80	10	青 色 13	260

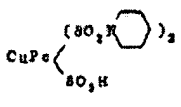
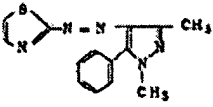
Key:

1. Example
2. Dye
3. Polymer prepared from polypropylene glycol and ethylene oxide
4. Mixing treatment
5. Solvent
6. Temperature (°C)
7. Time (h)
8. Color in toluene
9. Solubility (dye/100 volume parts toluene)
10. Benzene
11. Toluene
12. Violet color
13. Blue color

実 験 1	2	3	4 混 合 処 置				8 トルエン 中の色相	9 溶解度 (染料/トルエン 100 重量部)
			5 溶 媒	6 温 度 (°C)	7 時 間 (分)			
10		ポリプロピレングリコールと エチレンオキシドとの重合物 $\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n\text{H}$ $-(\text{CH}_2\text{CH}_2\text{O})_m\cdot\text{H}$ $n = 15, m + m' = 16$	ベンゼン 10	50~ 60	20	青緑色 12	190	
11	$\text{CuPC} \begin{cases} (\text{SO}_2\text{NHC}_6\text{H}_4)_3 \\ (\text{SO}_3\text{H})_3 \end{cases}$	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n\text{H}$ $-(\text{CH}_2\text{CH}_2\text{O})_m\cdot\text{H}$ $n = 28, m + m' = 19$	トルエン 11	80~ 90	10	青 色 13	150	

Key:

- Example
- Dye
- Polymer prepared from polypropylene glycol and ethylene oxide
- Mixing treatment
- Solvent
- Temperature (°C)
- Time (h)
- Color in toluene
- Solubility (dye/100 volume parts toluene)
- Benzene
- Toluene
- Blue-green color
- Blue color

1 例	2 染料	3 ポリプロピレングリコールと エチレンオキサイドとの重合体	4 混合処理			8 トルエン 中の色相	9 溶解度 (染料/トルエン 100 容積部)
			5 溶媒	6 温度	7 時間		
12		$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_m\text{H}$	キシレン 10	80~ 85	1.0	青 色 12	110
13		$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_m\text{H}$ <p>$n = 30, m + m' = 19$</p>	トルエン 11	80~ 85	2.0	橙赤色 13	120

Key:

- Example
- Dye
- Polymer prepared from polypropylene glycol and ethylene oxide
- Mixing treatment
- Solvent
- Temperature (°C)
- Time (h)
- Color in toluene
- Solubility (dye/100 volume parts toluene)
- Xylene
- Toluene
- Blue color
- Orange-red color

1	2	3	4			8	9
			5	6	7		
14		ポリプロピレングリコールと エチレンオキシドとの重合物 3 $\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n\text{H}$ $-(\text{CH}_2\text{CH}_2\text{O})_m\text{H}$ $m = 27, m + n = 15$	ベンゼン 10	50~ 60	2.5	赤色 11	160

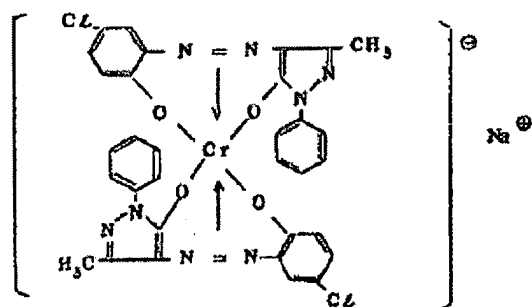
Key:

1. Example
2. Dye
3. Polymer from polypropylene glycol and ethylene oxide
4. Mixing treatment
5. Solvent
6. Temperature (°C)
7. Time (h)
8. Color in toluene
9. Solubility (dye/100 volume parts toluene)
10. Benzene
11. Red color

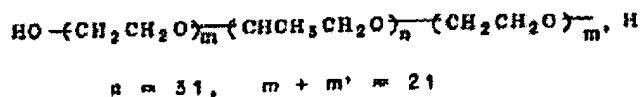
Example 15

/145

The 2:1 type chromium complex salt dye having a structure as shown below:



in an amount of 40 parts was mixed with 80 parts of the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown below:

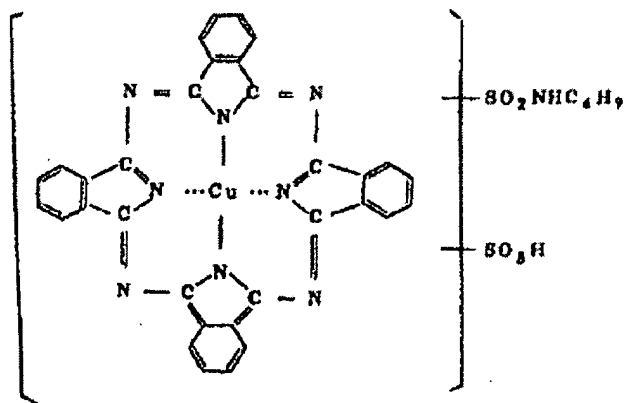


The mixture was kneaded using a 3-roll kneader (from Inoue Manufacturing Co.) at a room temperature for 1 hour to obtain 118 parts of the dye composition.

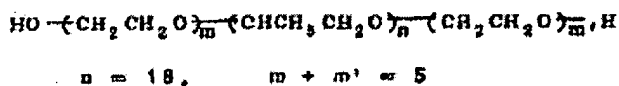
This dye composition was soluble in the aromatic hydrocarbon solvent such as benzene, toluene, styrene and the like, showing a red color and exhibiting a solubility of 210 parts/100 volume parts of xylene. On the other hand, the above 2:1 type chromium complex salt dye, prepared without the above mixing treatment, exhibited a solubility of 0.001 parts/100 volume parts of xylene.

Example 16

The copper phthalocyanine dye having a structure as shown below:



in an amount of 50 parts was mixed with 75 parts of the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown below:

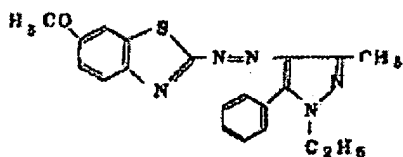


The mixture was kneaded using a 3-roll kneader at a room temperature for 1 hour to obtain 123 parts of the dye composition.

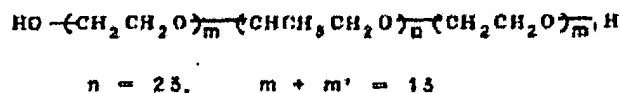
This dye composition was soluble in the aromatic hydrocarbon solvent such as benzene, toluene, xylene, styrene and the like, showing a blue color and exhibiting a solubility of 250 parts/100 volume parts of toluene. On the other hand, the above copper phthalocyanine dye, prepared without the above mixing treatment, exhibited a solubility of 0.003 parts/100 volume parts of toluene.

Example 18

The disperse dye having a structure as shown below:



in an amount of 20 parts was mixed with 30 parts of the polymer prepared from polypropylene glycol and ethylene oxide having a structure as shown below:



The mixture was kneaded using a 3-roll kneader at room temperature for 1 hour to obtain 48 parts of the dye composition.

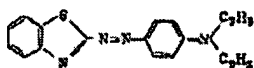
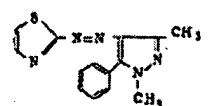
This dye composition was soluble in the aromatic hydrocarbon solvent such as benzene, toluene, xylene, styrene and the like, showing a red color and exhibiting a solubility of 280 parts/100 volume parts of toluene. On the other hand, the above copper dispersed dye, prepared without the mixing treatment, exhibited a solubility of 0.2 parts/100 volume parts of toluene.

The dyes as shown in the following tables were mixed with the polymer prepared from polypropylene glycol and ethylene oxide having a /146 structure as shown by the general formula (1) and the mixture was subjected to a mixing treatment using a 3-roll kneader to obtain the dye compositions which were soluble in the aromatic hydrocarbon solvent. The results are shown in tables below. In the tables, the solubility of the obtained dye compositions was measured using toluene. Also CuPc means the residue of the copper phthalocyanine group.

1	2	3	4	5		8	9	
				6	7	10		
19		80	<p>ポリプロピレングリコールと エチレンオキシドとの重合体</p> $\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ <p>$n = 19, m + m' = 7$</p>	40	20~ 25	2	棕色 10	350
20		40	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ <p>$n = 26, m + m' = 18$</p>	45	50~ 55	1	紅色 11	175

Key:

- Example
- Dye
- Parts
- Polymer prepared from polypropylene glycol and ethylene oxide
- Mixing treatment
- Temperature (°C)
- Time (h)
- Color in toluene
- Solubility (dye/100 volume parts toluene)
- Brown color
- Red color

1 例列	2 染料	3 部	4 リプロピレングリコールと エチレンオキシドとの重合体	5 混合処理		7 時間 (h)	8 トルエン 中の色相	9 溶解度 (染料100部/トルエン100部)
				6 温度 (°C)	6 時間 (h)			
21		35	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 15, m + m' = 8$	70	30~ 55	1	赤色 10	520
22		50	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 20, m + m' = 11$	110	20~ 25	0.5	赤色 10	290

Key:

- Example
- Dye
- Parts
- Polymer prepared from polypropylene glycol and ethylene oxide
- Mixing treatment
- Temperature (°C)
- Time (h)
- Color in toluene
- Solubility (dye/100 volume parts toluene)
- Brown color

1 試料	2 染料	3 部	4 ポリプロピレングリコールと エチレンオキシドとの重合体	5 混合処理			8 トルエン 中の色	9 溶解度 染料100部に対しトルエン
				6 温度 (°C)	7 時間 (h)			
23		70	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 30, m + m' = 14$	150 40~ 45	1	黄 色 10	250	
24		30	$\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 52, m + m' = 20$	50 20~ 30	1.5	青 色 11	220	

Key:

1. Example
2. Dye
3. Parts
4. Polymer prepared from polypropylene glycol and ethylene oxide
5. Mixing treatment
6. Temperature (°C)
7. Time (h)
8. Color in toluene
9. Solubility (dye/100 volume parts toluene)
10. Yellow color
11. Blue color

1	2	3	4	5		6	7	8	9
染料名	染料組成物	染料組成物	染料組成物	混合	時間	トルエン 中の色	染料組成物	染料組成物	染料組成物
25	$\text{CuPe}-(\text{SO}_3\text{H})_2$	30	ポリプロピレングリコールと エチレンオキシドとの重合体 $\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_m-(\text{CHCH}_2\text{CH}_2\text{O})_n-$ $-(\text{CH}_2\text{CH}_2\text{O})_{m'}\text{H}$ $n = 30, m + m' = 15$	70	50~ 60	1	青 10	293	

Key:

1. Example
2. Dye
3. Parts
4. Polymer prepared from polypropylene glycol and ethylene oxide
5. Mixing treatment
6. Temperature (°C)
7. Time (h)
8. Color in toluene
9. Solubility (dye/100 volume parts toluene)
10. Blue color